

## ALERTION IN NATURAL ENVIRONMENT OF NORTH UNDER THE IMPACT OF REPUBLIC SAKHA POWER SECTOR (YAKUTIYA)

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Intensification of industrial development in Republic Sakha (Yakutiya) has led to an escalation of ecological problems, including pollution of environment, and the most significant contribution to this process belongs to power complex. The article presents results of analyzing current condition and provides ecological evaluation of the predicted influence of RS(Y) power complex upon alteration of natural environment. The evaluation is based upon basic indicators: discharge of pollutants into atmosphere, dump of hazardous dirt into water objects, and also volume of production and consumption waste. As a result of the undertaken analysis of current condition we can outline that nowadays enterprises of heat power complex in Republic Sakha (Yakutiya) contribute greatly to formation of ecological situation, it consists of up to 80% of total discharge into atmosphere, up to 35% of total waste dumps into water objects, and up to 60% of production and consumption waste. Ecological evaluation of FPC upon perspectives of the republic has shown that the most hazardous objects remain coal power stations, enterprises of fuel extraction, and small boiler houses.

**Keywords:** natural environment, pollution, power complex, evaluation, prediction

Intensification of economic and social development in Republic Sakha (Yakutiya) has led to escalation of various ecological problems, including pollution of environment. The most significant contribution into this process belongs to fuel-power complex. It includes almost all sectors of power industry and uses all types of power resources, extraction, procession, and use of which has an active influence upon natural environment of North.

Russia holds third place in the world after USA and China in terms of discharging pollutants into environment and 74<sup>th</sup> place among ecologically-clean countries. The greatest atmosphere pollution takes place in result of power enterprises' activity and forms about 27% of total industrial discharge.

The bulk of pollutants' discharge into atmospheric air of RS(Y) comes from enterprises of electric power, coal, and gas industry. In 2013 of all Far-East federal district Yakutiya occupied second place in volume of pollutants' discharge into atmosphere (262,3 thousand tons) after Primorsk region (404,3 thousand tons) from all industrial sources.

In amount of polluted sewer waste dump into water objects RS(Y) occupies 4<sup>th</sup> place (75,63 million m<sup>3</sup>) after Primorsk (284,84 million m<sup>3</sup>), Khabarovsk (177,9 million m<sup>3</sup>), and Amur region (76,97 million m<sup>3</sup>).

Within Far-East federal district RS(Y) is the leading region in the greatest volume of placed wastes that equaled 288,322 million tons in 2013 (Khabarovsk region – 92,941 million tons).

The article presents some results of analyzing modern condition and provides ecological evaluation of the predicted influence of power complex of RS(Y) upon alteration of natural environment. Such evaluation has been received with facilitation of the existing methods

of predicting natural environment condition in terms of energetic development [5].

### Modern change in natural environment under the influence of energetics

The basic indexes that define antropogenic alteration of ecological nature condition are discharge of pollutants into atmosphere, dump of hazardous dirt into water objects, and also wastes of production and consumption.

**Discharge into atmosphere.** In 2013 amount of pollutants, discharged into atmosphere from stationed sources, equaled 165,14 thousand tons, of them 32,65 came from enterprises of oil-and-gas sector, and 39,48 thousand tons – from enterprises of power sector, and it equaled almost 50% of total industrial waste (Fig. 1) [3].

The degree of negative influence upon the environment is mostly dependent upon type of power source and the used types of fuel. In total volume of most wide-spread pollutants during 2000–2013 gas and liquid substances prevailed, and they are the main air pollutants. In structure of discharge in 2013 volume of carbon oxide equaled almost 43,8% of all discharges, nitrous oxide – 16,5%, sulphur dioxide – 6,4%. Solid substances formed 26,6% [3].

The greatest polluter of atmospheric air in Republic Sakha (Yakutiya) is JSC AK “Yakutskenergo” that consists of 7 branch offices and 4 subsidiaries. The basic types of activity for this company are production, distribution, transition, and sale of electric and heat power to consumers.

During the period 2009–2012 a growth in volume of pollutants' discharge into atmosphere happened at the enterprise: sulphur dioxide – by 2,1, nitrous oxide – by 2,1, carbonic oxide – by 1,4. On the contrary, volume of hazardous discharges into atmosphere decreased by 2% since 2012 till 2013 (Fig. 2) [1, 2, 3].

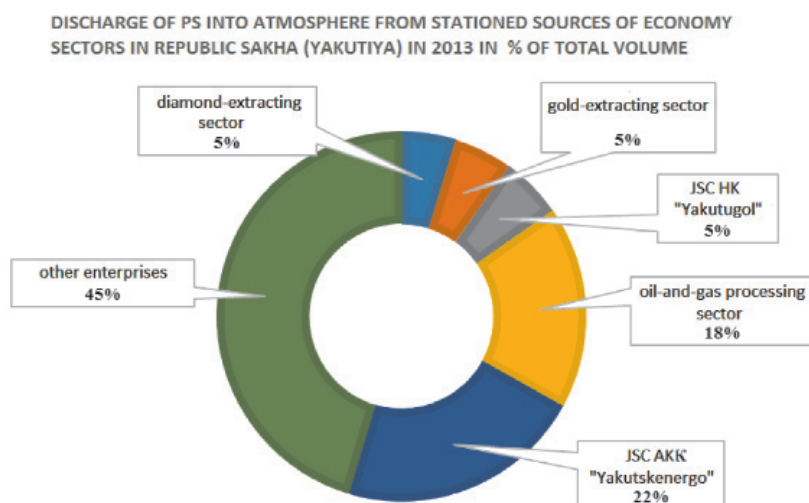


Fig. 1. Structure of economy sectors' contribution in atmospheric pollution [3]

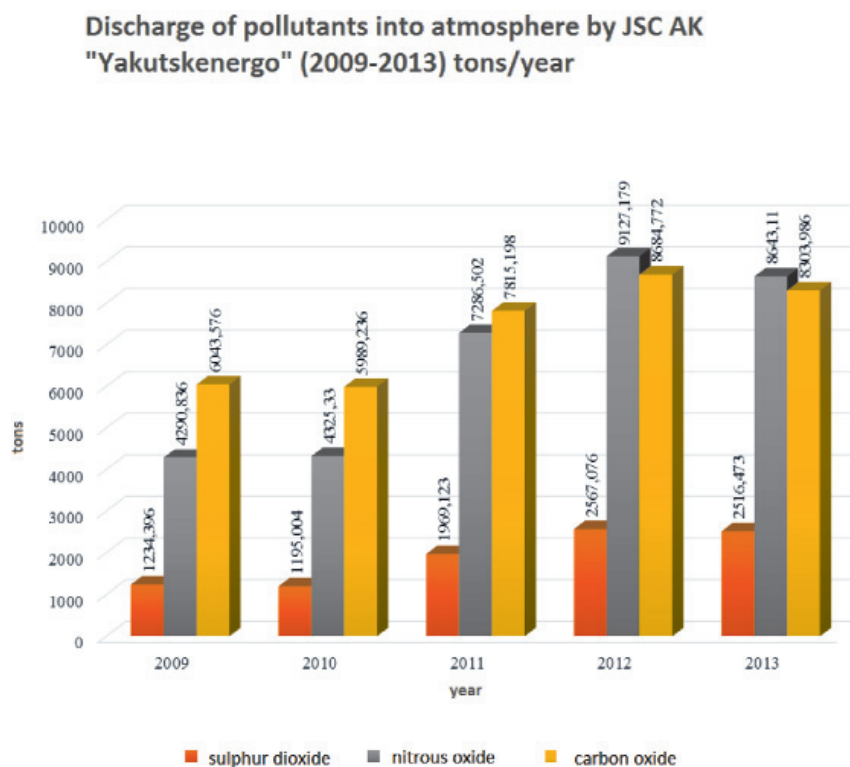


Fig. 2. Discharge of pollutants into atmosphere by JSC AK "Yakutskenergo" (2009–2013)

**Waste dumps into water objects.** Quality of surface waters is defined by indexes of sewer dumps into water objects. Nowadays in comparison to 2008 total dump of sewer waters from all economic sectors of Republic Sakha (Yakutiya) has increased by 8,3 %, but the volume of dirt decreased by 21,5 %. Within structure of sewer waters dirt forms almost 40 %. Among regions of Far East

federal district in 2013 contribution of Yakutiya in total mass of dirt equaled 12,4 % (133,1 thousand tons) of total dump of pollutants into surface water pools [3].

The leading position in total pollution of Yakutiya water objects belongs to large mining industry. Contribution of fuel-power complex into total dump of pollutants has equaled 30-35 % during recent years.

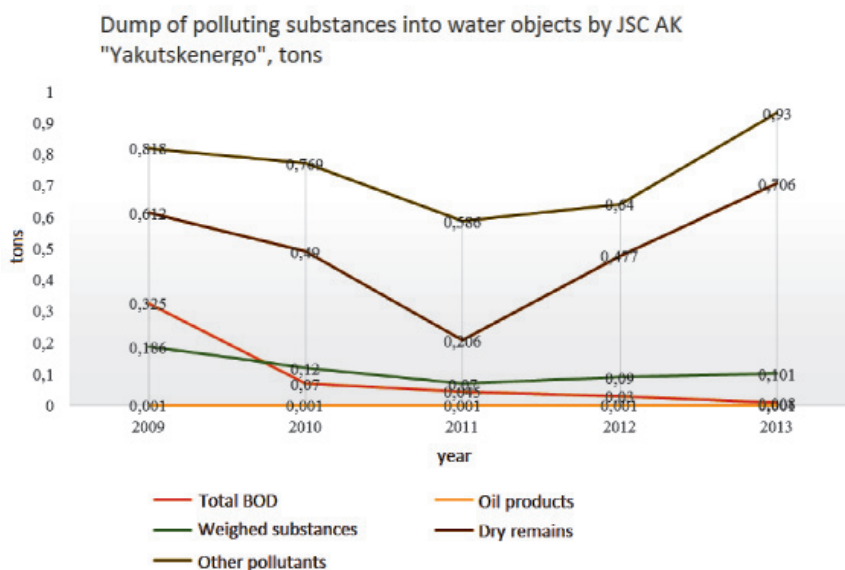


Fig. 3. Dump of polluting agents into water objects by JSC AK "Yakutskenergo" (2009–2013) [4]

Fig. 3 shows dynamic of dirt dumps according to their chemical composition during the period 2009–2013 decrease in total BOD from 0,325 tons to 0,008 took place, weighed substances – from 0,186 to 0,101 tons, but dump of dry remains grew from 0,612 tons to 0,706 tons, and of others – from 0,818 to 0,930 tons [4].

Analysis of surface water quality throughout pools of large Yakutiya rivers shows us that water object are still exposed to a severe antropogenic strain. Mostly water quality re-

mained unaltered during the recent years, as new powers of cleaning facilities have not been put into use, the existing facilities have not been reconstructed, though they are worn-off and use outdated technologies of filtration.

**Wastes.** One of the urgent problems of the republic is formation and accumulation of production and consumption waste. The share of power objects in total amount of wastes equals about 60%, and it has increased almost 1,8 times during the recent years, and it has a special reflection in wastes of class – 5 (Fig. 4) [4].

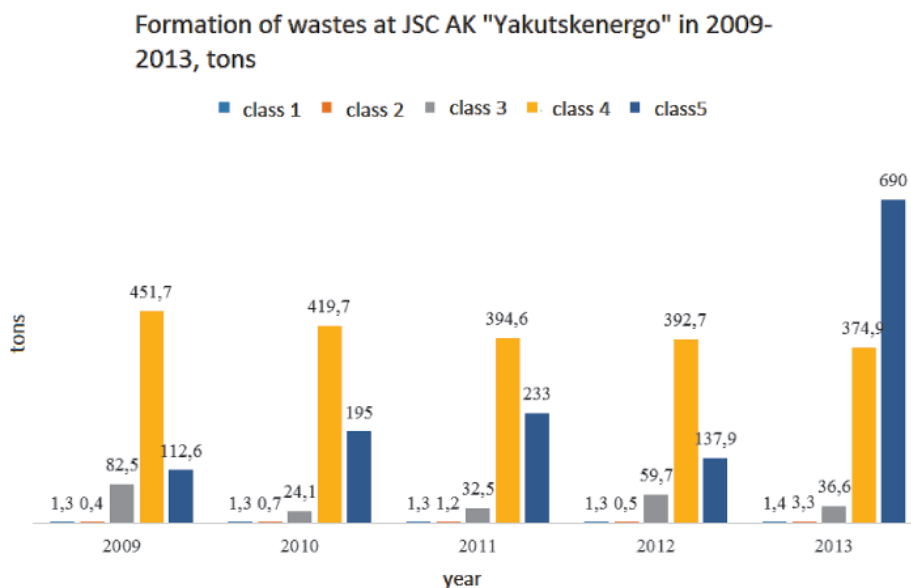


Fig. 4. Formation of wastes by JSC AK "Yakutskenergo" in 2009–2013 [4]

Due to lack of specialized enterprises of utilizing (burying) chemical wastes (wastes of HPS) in Republic Sakha, their transportation to polygon of burying industrial waste in the city of Krasnoyarsk is undertaken.

#### Evaluation of perspective change in natural environment

On the whole, ecological pollution of atmosphere carries local nature throughout the republic. A high level of pollution is observed in the largest inhabited areas, where enterprises of heat-power complex and diamond procession are located.

Ecological evaluation of heat-power complex development perspective has been done for two scenarios: strategic and moderate, and strategic variant has been accepted for favourable conditions of realizing power investment projects, and moderate – for less favourable, defined by objective economic reasons.

The undertaken calculations of total discharge into atmosphere during the period of 2013–2030 have shown its growth by 1,6 for both moderate and strategic scenarios, and it equals 202–203 thousand tons in 2030 (Fig. 5) [6].

among number of boiler houses that belong to main gas pipelines.

Discharges by diesel power stations will decrease in the studied period due to a decrease in volume of diesel fuel consumption.

Calculating dynamic of hazardous substances' discharge in the republic power regions for period 2008–2030 has shown that the greatest growth will happen in Southern-Yakutsk power region – by 2,4, in Northern – by 1,2. Discharge will remain practically at the same level in Central power region and will decrease by 1,3 in the West [6].

From the position of FPC impact upon water objects we should outline that sewer waters of large HPS and HRPS are formally clean in 95% of all cases. Enterprises of dwelling-communal complex will remain the main sources of water pollution in long-term perspective.

A special feature of the republic's power complex is the planned large-scale development of hydroenergetics. In this regard, regulation of sewer and water storage will have a great impact upon the environment. Change in hydromechanical water flow regime due to deconsumption of flooded

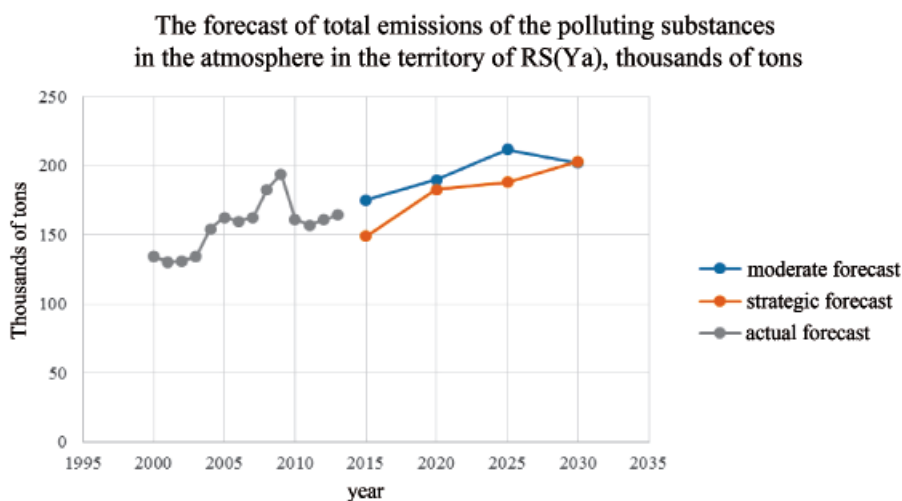


Fig. 5. Predicted total discharge of pollutants into atmosphere at the territory of RS(Y) [6]

In case of moderate scenario gradual growth in HEC discharge is observed, while strategic scenario implies is great growth from 2020 that is defined by more intense consumption of coal at new Elginskaya HPS and Elginskaya HRPS as well as expansion of Neryunginskaya HPS.

Dynamic of discharge by boiler houses for both scenarios is decreasing due to modernization of boiling equipment and gasification

soil grounds and remaining plants as well as pollution with industrial and household sewer waters will serve as the major negative ecologic factor.

One of important ecologic indexes of fuel-power complex development in the republic is formation of ash-slag wastes. According to enlarged evaluations, by the end of 2030 amount of ash slag will equal 1,2 million tons per year for the moderate scenario and 1,5 million tons

per year for the strategic scenario. Considering the significant amount of wastes, accumulated at the republic territory nowadays – about 1,2 billion tons, solving problems of storing (construction of ash slag dumps) and utilization of this waste should be planned.

In result of the undertaken analysis of modern condition we can outline that nowadays enterprises of FPC have a great contribution into formation of ecologic situation in Republic Sakha (Yakutiya) that forms up to 80 % of total discharge into atmosphere, up to 35 % of total dump into water objects, and up to 60 % of production and consumption wastes.

Ecologic evaluation of FPC development in terms of republic perspective has shown that coal power stations, enterprises of fuel extraction, and small boiler houses remain the most ecologically-hazardous objects. Atmosphere, water, and land resources are exposed to significant influence in process of power sector development.

In order to decrease anthropogenic influence of electric and heat power objects upon natural environment it is necessary to intensify enterprises' activity in terms of providing the following nature-preserving measures:

- improvement in structure of the burnt fuel via decreasing part of using coal and black oil along with increase in burning of natural gas;
- gasification of small boiler houses of equipping them with modern dust-cleaning facilities;

- introduction of modern tools for dust and water cleansing into all large power enterprises;
- rational water consumption and decrease in amount of dirt wastes due to installation or modernization of sewer waters filtration systems;
- introducing system of processing and utilizing ash slag wastes at large power enterprises;
- recultivation of the damaged lands.

Thus, for the territory of Republic Sakha (Yakutiya) with its intense nature of business and production, it is necessary to develop an ecologic policy and principles of undertaking nature-preserving measures that will provide for preservation of natural resources and regulate parameters of keeping fragile Northern nature safe and in balance.

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